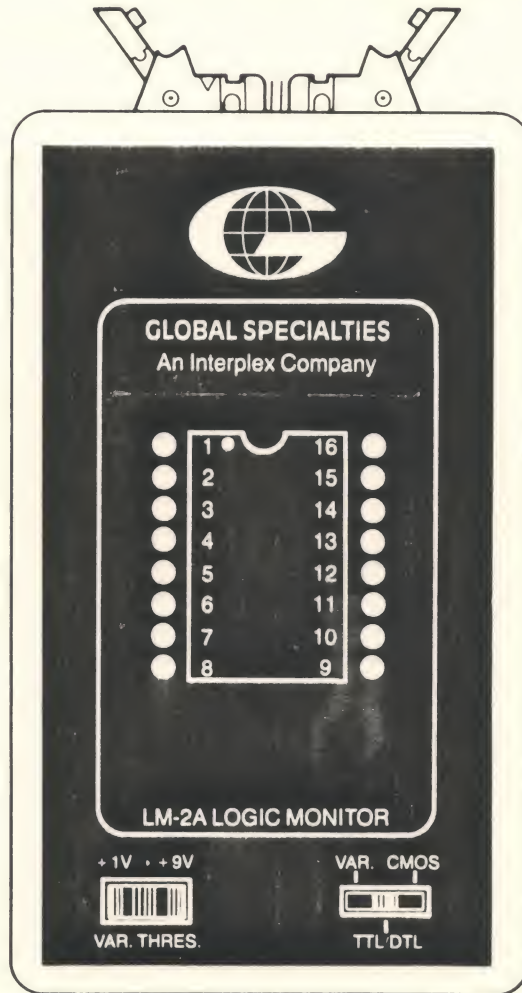


# LM-2A LOGIC MONITOR



## INSTRUCTION MANUAL

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**GLOBAL SPECIALTIES<sup>®</sup>**  
An Interplex Electronics Company  
70 Fulton Terrace, P.O. Box 1942  
New Haven, Connecticut 06512  
(203) 624-3103 • FAX (203) 468-0060



## LM-2A SPECIFICATIONS

INPUT:	24" ribbon cable terminated in a 16-pin Proto Clip® IC test clip Impedance: 1.0 MegOhm @ 30pf with 24" cables Voltage Range: 0-15VDC ( $\pm 50$ VDC max)
Vcc INPUT:	Samples Vcc of circuit under test thru case mounted counter Impedance: $>20K$ ohm Voltage Range: 0-15VDC (-0.7 to 50VDC max)
THRESHOLD REFERENCES:	Threshold Voltage for 16 input channels are determined by the setting of the threshold mode selector TTL: 2.3VDC $\pm 0.1$ VDC CMOS: 70% Vcc $\pm 0.2$ VDC VARIABLE: Adjustable 1.0VDC to 9.0VDC $\pm 0.2$ VDC
CONTROLS:	Threshold Mode Select (TTL, CMOS, VARIABLE), Variable Threshold
CONNECTORS:	Signal, Vcc sense, power input, threshold voltage reference test point
DISPLAY:	16 high intensity LEDS; on when corresponding input exceeds threshold; off when input below threshold or floating. Partial intensity indicate of signal duty cycle.
POWER:	9.3VDC @ 115mA max
DIMENSIONS:	5.9 X 3.2 X 1.2, L X W X H (150 X 81 X 30mm) 15 oz (425gm)
OP TEMP:	0-40°C
INCLUDES:	Instruction manual, LDA-8 Vcc Sense Cable, MMAC-2 AC Adapter, LMA-8 16-Conductor Input Ribbon Cable
OPTIONS:	LMA-9 16-Conductor Input Ribbon Cable unterminated, 10 black & 10 red quick hooks, LMA-10 36" (914-mm) Power Cable with alligator clips

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## INTRODUCTION

Your LM-2A Logic Monitor is a unique design and circuit testing tool which will simultaneously monitor and display the static and/or the dynamic states of up to 16 TTL or CMOS compatible circuit points. The Monitor also has a variable feature which enables manual threshold settings.

The LM-2A will instantly and clearly display the logic states of any digital IC of up to 16 pins or any of up to 16 independent circuit points when used with its standard supplied connector cable terminated with a 16-pin IC test clip or the optional multi-point universal test cable respectively.

The voltage at each input test point is measured by one of the 16 independent binary voltmeters within the LM-2A. If the voltage at any of the input points exceeds 2.3 volts (TTL), 70% of Vcc (CMOS) or the manually adjusted threshold (VARIABLE), a LED corresponding to the activated input will be displayed on the LM-2A's easy-to-read display. Uncommitted (floating) inputs will not activate the display.

We're sure that you'll find the LM-2A 16-pin Logic Monitor an indispensable tool when working with digital circuits and systems.

## OPERATING INSTRUCTIONS

### Initial Inspection

Your LM-2A 16-pin Logic Monitor comes ready to use with a 16-conductor input cable terminated in a single 16-pin Proto Clip<sup>®</sup> IC Test Clip, instruction manual, Vcc Sense Cable and AC Adapter.

The optional universal cable kit is available for special interfacing requirements and may be ordered from Global Specialties Corporation (specify LMA-9).

Carefully remove the LM-2A from its protective packaging and carefully inspect your LM-2A for damage. The controls should operate easily and positively when moved from position to position. Inspect the input pins of the male connector located in the top of the LM-2A, making sure that there are no bent or missing pins.

In the unlikely event that your LM-2A has been damaged in shipment, please return it to the place of purchase or you may send it to the Global Specialties Corporation. See Warranty, Factory Service and Repair section of this manual.

With the inspection complete, you are now ready to set up your LM-2A 16-pin Logic Monitor for operation.

## SET-UP

Please refer to Figure 1. Plug the AC Adapter or optional power cable into the jack provided on the side of the LM-2A. If the AC Adapter is used, plug it into an AC socket. If the optional cable (LDA-10) is used, apply a DC voltage (9-15VDC) to it, positive to the red alligator clip, negative to the black alligator clip. (Note: the LM-2A is protected against accidental reversal of these leads).

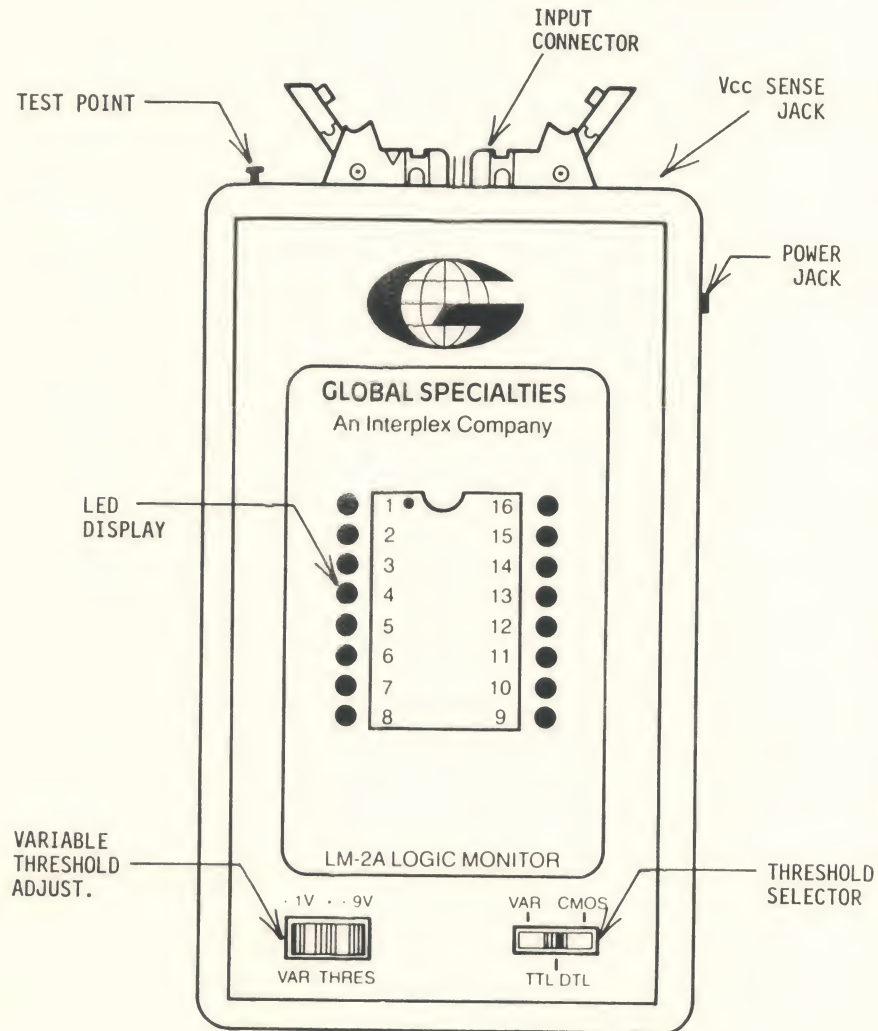


FIGURE 1  
FRONT PANEL CONTROLS

Carefully insert the input cable into its mating connector located in the top of the LM-2A, as shown in Figure 2. Note that the connector is keyed and may only be inserted in one direction. DO NOT FORCE the matings. Improper alignment will result in damage to the connector pins. The input connector is properly seated when the side locks close in place holding the ribbon cable to the LM-2A.

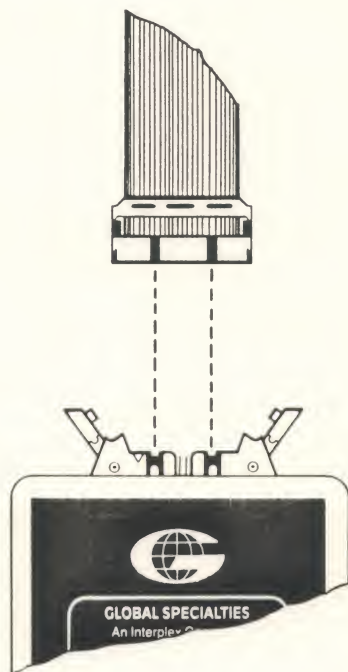


FIGURE 2

Next, insert the Vcc Sense Cable into the jack provided on the top of the LM-2A. Connect the black alligator clip to the ground of the circuit to be tested. If you are testing CMOS, the red alligator clip must be connected to the Vcc of the circuit.

Adjust the three position threshold selector switch for the logic family to be tested. (Note: If the threshold selector switch is set for CMOS and the Vcc Sense Cable is installed, but no voltage is applied to the red alligator clip, the 16 LEDs on the unit will turn on.)

To attach the proto clip to the IC, squeeze the top section of the clip together, opening the jaws at the bottom of the clip. Slip the jaws over the IC making sure that the No. 1 contact on the clip matches the No. 1 lead on the IC. Once the clip is in place, the LEDs instantly display the logic states of the IC. See Figure 3.



FIGURE 3

Each IC lead is connected to a logic state comparator contained in the LM-2A module. When an input voltage exceeds the preselected threshold, the LED corresponding to that input is turned on. Inputs below the threshold (or uncommitted floating IC leads) do not activate their corresponding LEDs.

Any IC lead connected to  $V_{cc}$  will read a constant logical 1 (LED on). Grounded IC leads will read a constant logical 0 (LED off).

By reducing the IC input signal rate to 10Hz or less, each logic state of the IC under test can be seen.

When using the VARIABLE mode, the test point output should be monitored with a voltmeter, while adjusting the VARIABLE thumbwheel until the required threshold for the circuit under test is reached. An input voltage exceeding the preselected threshold turns on the LED corresponding to that input. Inputs below the threshold do not turn on their corresponding LEDs. Example: If the circuitry being tested contains DTL or RTL logic, then the VARIABLE thumbwheel should be adjusted for a test point voltage of 1.6 or 1.2 volts respectively.

The VARIABLE mode is a unique feature of this second generation LM-2 Logic Monitor, where the user has the ability to test all logic families by simply adjusting the VARIABLE thumbwheel for the required threshold.

## CIRCUIT DESCRIPTION

The LM-2A circuitry is best explained by following the schematic enclosed.

Diode D33 is provided to protect the LM-2A from lead reversal when using circuit power instead of the AC Adapter.

Each of the 16 test pins on the test clip connects through a  $\pm 2$  attenuator (1% resistors R1-R32) to the inverting inputs of comparators (U1-U4). These inputs are protected from negative voltages by diodes (D17-D32). All the non-inverting inputs are tied to the logic threshold line. When a test pin input exceeds the threshold voltage, the comparator output goes to ground, activating its corresponding LED. (LED Current limiting is provided by resistors R33-R48).

The TTL and VARIABLE threshold voltages are derived from a Zener diode (D35). 1% resistors (R53-R54) divide the Zener voltage to create the TTL threshold. The VARIABLE threshold voltage is obtained by the adjustment of front panel thumbwheel pot. R55.

1% resistors (R50-R51) divide the Vcc Sense voltage to create the CMOS threshold level.

In all three modes the threshold voltage is applied to a voltage follower ( $\frac{1}{4}$  of U5) and, in turn, to the reference comparator inputs.

The voltage follower output is also fed to an op-amp ( $\frac{1}{4}$  of U5) which acts as a X2 amplifier. The output of this amplifier is brought to the threshold voltage test point for monitoring threshold voltage directly.

In order to obtain a VARIABLE threshold range of 1V to 9V, the supply voltage to U5 had to be increased by 2 volts. This was necessary because the output voltage swing of U5 is limited to 2 volts less than the supply voltage. This was accomplished with a circuit comprised of  $\frac{2}{4}$  of U5, Q1, and associated voltage doubling diodes and capacitors.

The 16 threshold comparators require a negative supply voltage if they are to operate with a zero input voltage. A "virtual" negative supply voltage is provided through the use of diode (D34).

## WARRANTY

Global Specialties® warrants this device to be free from defective material or workmanship for a period of one full year from the date of original purchase.

Global Specialties® under this warranty is limited to repairing the defective device when returned to the factory, shipping charges prepaid, within one full year from date of original purchase.

Units returned to Global Specialties® that have been subject to abuse, misuse, damage or accident, or have been connected, installed or adjusted contrary to the instructions furnished by Global Specialties®, or that have been repaired by unauthorized persons will not be covered by this warranty.

Global Specialties® reserves the right to discontinue models, change specifications, price or design of this device at any time without notice and without incurring any obligation whatsoever.

The purchaser agrees to assume all liabilities for any damages and/or bodily injury which may result from the use or misuse of this device by the purchaser, his employees, or agents.

This warranty is in lieu of all representations or warranties expressed or implied and no agent or representative of Global Specialties® is authorized to assume any other obligation in connection with the sale and purchase of this device.

## BREADBOARDING SOCKETS LIFETIME GUARANTEE

All Global breadboarding sockets are guaranteed for life. If a socket ever fails to meet your requirements, return it and we will replace it, NO QUESTIONS ASKED.

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